

Sudden Impulse Event Detected by FMCW Doppler Observation on 14 July, 2012.

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The coronal mass ejection (CME) event associated with solar flare of X1.4 was occurred at 16 UT on 12 July, 2012. The ejected gas propagated through the interplanetary space and reached at Earth at 18UT on 14 July. At the same time, the interplanetary shock (IPS) formed on the leading edge of the propagating solar ejecta buffeted the magnetosphere and caused the Sudden Impulse (SI) event.

The magnetic variation on the ground shows the step-like variation from 1810UT in H- component at the low and middle latitude stations along the 210 degree meridians which was located post-midnight sector during the SI event. The magnetic variation at Glyndon (Mag. Lat. = 57.07, Mag. Long. = 330.02) which was at 11MLT shows the bipolar magnetic variations in H- component. The first impulse correspond the Preliminary Reverse Impulse (PRI) of SI event, which was produced by the temporal variations of ionospheric current driven by the electric potential field imposed on the polar ionosphere.

On the other hand, the FMCW radar installed at Inubo station (Mag. Lat. = 27.01, Mag. Long. = 209.9) was operated in doppler mode with base frequency of 4 MHz during the SI event. The sudden depression of the doppler velocity of -1.5 m/s was observed at 1810UT corresponding to the PRI signal in the magnetic data at Glyndon. The PRI magnetic variations could be thought the subsequence of the ionospheric current system produced by the sudden compression of the magnetosphere, so that the PRI signals was not detected in the magnetic variation at nighttime sectors because of the low ionospheric conductivity. However, the variations of the doppler velocity at nighttime sector corresponding to the SI event indicated that the electric field imposed on the polar ionosphere could propagate simultaneously event in the night time sectors.

The present result suggests that FMCW radar observation could be a strong tool for the SI and or ULF wave studies especially at the night time sector, in which the magnetic variation originated from the ionospheric current could not observed.